

QUALITY IMPROVEMENT REPORT

Improving medication management for patients: the effect of a pharmacist on post-admission ward rounds

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Problem: Medication management in the NHS has been highlighted by the UK Department of Health as an area for improvement. Pharmacist participation on post-take (post-admission) ward rounds was shown to reduce medication errors and reduced prescribing costs in the USA and in UK teaching hospitals, which can contribute to improved medication management. We sought to demonstrate the problem in our hospital by collecting data on prescribing practice from three consecutive general medical post-take ward rounds.

Setting: Northwick Park Hospital, a district general hospital in north-west London, which provides acute medical services to a population of 300 000.

Strategy for change: A pharmacist was invited to become a member of the post-take ward round team that reviewed medical patients admitted within the preceding 24 hours. Patients also continued to receive care from a ward based pharmacist. Patient notes were analysed for cost of drugs on admission and discharge, discrepancies between admission drug history and pharmacist history, number of admission drugs stopped before discharge, and pharmacist recommendations. Pharmacist recommendations and actions were classified using a National Patient Safety Agency risk matrix.

Effects of change: Discrepancies between the admission and the pharmacist derived drug history were noted in 26 of 50 in the pre-intervention group and 52 of 53 in the intervention group. The annual drug cost per patient following discharge increased by £181 in the pre-intervention group and by £122 in the intervention group. Five pre-admission drugs were stopped in three pre-intervention patients saving £276 per annum, while the 42 drugs stopped in 19 intervention patients saved £4699 per annum. No ward based pharmacist recommendations were recorded in the pre-intervention group. Recommendations regarding drug choice, dose, and need for drug treatment were most common; 58 minor, 48 moderate and four major risks to patients were potentially avoided.

Lessons learnt: The presence of a pharmacist on a post-take ward round improved the accuracy of drug history documentation, reduced prescribing costs, and decreased the potential risk to patients in our hospital. As a result of this work a full time pharmacist has now been funded to attend daily post-take ward rounds on a permanent basis.

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We were aware that optimising medication management was often neglected when patients were admitted to our hospital, but no data existed to quantify this problem. A literature review showed that the problem was not unique to our hospital. The Department of Health in the UK estimates that 10% of patients admitted to UK hospitals as an emergency suffer some kind of safety incident.¹ The UK National Patient Safety Agency (NPSA), an NHS body that collects and analyses data regarding patient safety, has suggested that 900 000 incidents harm or nearly harm NHS inpatients in the UK annually; 12–20% of these incidents are related to medicines, with medication errors occurring most commonly in the area of prescribing, dispensing or administration. Research from the USA suggests that medication errors often result from lack of sufficient information during the prescribing stage.² Other work from the USA has estimated that each adverse drug event costs \$2000–2500.³

We sought to quantify this problem through a retrospective audit of three consecutive medical post-take ward rounds (PTWRs) from one clinical team and to examine whether the addition of a pharmacist to the post-take medical team would effect any change. A review of the literature showed that the presence of a pharmacist on PTWRs in the USA reduced drug errors² and prescription costs.⁴ Work in the UK has focused on large teaching hospitals where the presence of a pharmacist on PTWRs showed benefits to patient care from the pharmaceutical contributions, especially detecting errors.⁵

Hospital pharmacists detect errors in around 1.5% of prescription items written.⁶ A study analysing medication error in selected teaching and non-teaching NHS trusts across London and the South East for 5 days during November 2002 showed that a total of 1377 moderate, major, and potentially catastrophic errors occurred in that period.⁷ However, no such work has been published for UK district general hospitals such as ours, looking at drug error, cost of medication and, especially, assessing risk as per the NPSA scoring system. Specifically, the study sought to assess the impact of the pharmacist on the PTWR on prescribing (including drug histories), drug expenditure, and medication associated risks.

CONTEXT

In the UK, acutely ill patients are seen in hospital either at the request of their community physician (GP) or following self-presentation to the emergency department. A junior doctor will review and examine such patients as well as order basic clinical investigations and will then make a decision whether to admit such patients for ongoing medical care. Admitted patients will be reviewed on a ward round by the senior doctor responsible for the care of all patients seen by the junior doctors in the previous 24 hours. These "post-take" (post-admission) ward rounds often involve a large number of people—the senior doctor, many of the junior doctors who have admitted patients, nurses, physiotherapists, and medical students (box 1). The PTWR is the first—and often

Box 1 Post-take ward round (PTWR) participants

- Consultant
- Registrar
- Junior doctors
- Medical student
- PTWR pharmacist
- Nurse in charge

the last—opportunity for a multidisciplinary review of medication to take place, although there is no pharmacist present on these ward rounds in our hospital.

Many hospitals employ clinical pharmacists to review prescription charts on the wards and at discharge. In our hospital we have pharmacists who each attend a 28 bed ward for 1–2 hours at some time during the working day. Clinical pharmacists make recommendations to the clinical team regarding medication already prescribed. We proposed that, if the pharmacist was present when prescribing decisions are made, there would be greater opportunities to review current medication, reduce polypharmacy, and reduce medication related risks and costs. In addition, recommendations for commencing appropriate drugs for new conditions may be made.

ASSESSMENT OF PROBLEM

We decided to establish a baseline for prescribing at our hospital by conducting a pre-intervention phase (without a PTWR pharmacist) where only the standard ward pharmacy services were provided. These services operate with pharmacists performing their rounds at different times to the clinical teams, identifying clinical interventions after the prescribing decision has been made. Data collection took place between April and July 2003 at Northwick Park Hospital, a district general hospital with 800 acute beds in north-west London serving a population of 300 000. One general medical team was selected for the project and the members of the team remained the same throughout the data collection phase.

The pre-intervention phase involved retrospective audit of patient notes using patient lists obtained from three consecutive acute general medical PTWRs. No pharmacist had been present on these ward rounds. The existing clinical ward pharmacist had provided a standard pharmacy service throughout these patients' admission. Following discharge, the patients' notes were collected and analysed for documentation of acute and chronic diagnoses, reasons for admission, and a review of the medications before admission, during admission, and at discharge. The notes were also analysed for documentation of the reasons for alterations to medication charts. Details of clinical ward pharmacist drug history taking were collected, together with any recommendations documented as part of the routine ward pharmacy service. Changes to medication on admission made by the medical team were also recorded. This work was carried out by a volunteer medical student who also had completed a degree in pharmacy before entering medical school. The work was reviewed with the specialist registrar (MF).

Data were analysed using a specifically designed database in Microsoft Access, allowing comparison of figures using Microsoft Excel. At data entry there was a retrospective review of risk, using the then current NPSA guidelines on identifying clinical risk and the associated scoring system, to evaluate identified events. Using this model, potential risks were assigned a cost and therefore potential savings identified. For the pre-intervention group this was based on entries in the notes (including drug chart) or, where not recorded, through interpretation of inpatient drug chart,

examining changes from preadmission drug history. The difference in medication costs between admission and discharge were calculated based on the March 2003 edition of the *British National Formulary*. Data were analysed for both pre-intervention and intervention phases after the end of the data collection period. χ^2 analysis was not done on these results as the sample size was too small to show any significant difference as discussed with the Northwick Park Hospital statistician.

Of the 62 patients in the pre-intervention group, notes were found for 50; 26 patients (53%) had differences in the medication history between those documented by the admitting team and any work carried out by the ward based pharmacist. The mean predicted increase in the cost of medication following the hospital stay was £181 per patient per year. This was reflected in the analysis of costs by diagnosis. The mean saving from drugs stopped during admission was £5.52 per patient per year. No recommendations regarding medication changes, errors, or risk management were documented in the patients' notes.

STRATEGY FOR CHANGE

This phase sought to identify whether adding a senior clinical pharmacist on the PTWR, liaising with the ward based junior clinical pharmacists, would make savings in both potential risks and actual drug costs. We envisaged that front loading resources to the early stages of admission would enable senior clinicians to make management decisions that would otherwise be delayed or not taken at all. For example, making a radiologist available in a medical assessment unit changed management immediately in 11% of cases.⁸

The need for ethical approval for this work was discussed with a senior member of the Trust's research ethics committee. Permission for the project to occur without the need for full committee approval was granted as the PTWR pharmacist provided pharmaceutical care which was accepted by the trust to be part of the pharmacist's role.

A senior clinical pharmacist attended three consecutive PTWRs which occurred 3 months after the pre-intervention phase. The pharmacist was introduced to the medical team by the consultant and registrar (senior medical staff), explaining the role envisaged. Once the medical team were familiar with the role of the ward based clinical pharmacist, the pharmacist was accepted as part of the multidisciplinary team on the PTWR. As this project was not funded, there was no further pharmacist time available to attend more than three PTWRs. All members of the medical team were the same for the three ward rounds and had also been the same team whose records had been analysed as part of the pre-intervention phase. The pharmacist obtained a drug history in addition to the doctors' admission drug history either from the patient, a relative, or a recent community prescription. Efforts were made during the ward round to contact the patient's GP where drug history or indications for prescribed medication were not clear. The pharmacist was present throughout the ward round, listening to the history and observing the clinical examination. The pharmacist contributed to prescribing decisions, including suggestions for stopping inappropriate treatment and initiating evidence based prescribing for new and existing conditions. These suggestions were recorded on a separate form (intervention form) that was retained by the pharmacist. Agreement was made with the consultant to follow up, review, and amend medications as agreed on the PTWR. All changes were documented on the drug chart or in the patients' notes. The clinical ward pharmacist followed up all queries generated during the PTWR within 24 hours. Peer review sessions were held after each PTWR. The two senior pharmacists examined all intervention forms. Optimal medicine management strategies were discussed to ensure consistency

Table 1 Accuracy of medication history

	No of patients	No of patients with differences in medication history	No of differences in medication history	% patients with medication history differences
Pre-intervention	50	26	123	53%
Intervention	53	52	284	98%

of advice provided to the medical team and agree the classification of contributions and entries. Consensus between the two post-take pharmacists was reached for all forms.

BARRIERS TO CHANGE

The main barrier to implementation of this work was the lack of funding to allow the pharmacist to attend the PTWR. This was despite the fact that this study showed that the work was of benefit to patients in terms of medication management and saved money for the trust and the health economy. We envisaged a potential for antipathy from the existing PTWR team to the presence of a pharmacist, which we did not experience. The pharmacist was required to attend the whole ward round (as it was too disruptive to leave and rejoin), although a large proportion of the ward round discussion was not relevant to medication. It took the pharmacist a long time to contact health and social care professionals and carers about patients' medication to allow confirmation of drug histories. Thus, finding the time for the pharmacist to fulfil these roles was difficult.

In addition, we recognised that a senior pharmacist was needed to fulfil the role required and recruitment of staff at this level can be difficult.

EFFECTS OF CHANGE

Impact of the pharmacist on PTWR on drug expenditure

Of the 57 patients in the intervention group, notes were found for 53; 52 patients (98%) had differences in medication history between those documented by the admitting team and any work carried out by the ward based pharmacist (table 1). The mean predicted increase in the cost of medication following the hospital stay was £122 per patient per year (table 2). This was reflected in the analysis of cost by diagnosis (table 3). The mean saving from drugs stopped during admission was £88.60 per patient per year (table 4).

Impact of the pharmacist on PTWR on medication associated risks

The NPSA produced a risk assessment tool following adverse incidents affecting NHS patients. The NPSA risk classification (see Appendix 1 available online at <http://www.qshc.com/supplemental>) is divided into five levels of risk for both severity of the potential error and probability of the error occurring. These categories examine the actual or potential impact of the harm to the patient or the organisation in terms of severity of harm, number of patients potentially affected,

and effect on the organisation. The potential financial consequences of the harm are estimated.

One hundred and nine recommendations regarding medication changes, errors, or risk management were documented in the patients' notes and on the PTWR pharmacist intervention forms (table 5). The majority of recommendations were of minor or moderate significance (53% and 43%, respectively) and four (5%) were classified as preventing a potentially major incident (table 6).

The tables show the results of pre-intervention and post-intervention data collection. The impact on prescribing of the pharmacist on the PTWR is described by the accuracy of the medication history (table 1), the difference in predicted annual cost of drugs between groups (tables 2–4), and the clinical interventions (tables 5 and 6).

Table 1 shows the number of differences between medication history documented by the admitting doctor and the actual medication taken by the patient as documented by the pharmacist. These results reflect the published literature where pharmacists have been shown to produce more accurate medication histories on admission than junior doctors.

Table 2 shows that there was an increase in drug cost per patient in the pre-intervention and intervention groups. Increases are to be expected given that most medical treatments in hospital will include drug therapy. However, there is a clear difference in the magnitude of the cost increases, with the intervention group showing a smaller increase. This may be attributed to the contribution of the PTWR pharmacist to the management of the patient including recommendations for stopping unnecessary medication on admission and optimising treatment during the hospital stay and for discharge.

Table 3 identifies cost differences between pre-intervention and intervention groups in specific diseases commonly found in elderly patients. Patients with congestive cardiac failure or stroke in the intervention group showed smaller increases in predicted annual medication costs than patients in the respective pre-intervention groups. COPD patients in the intervention group showed a reduction of £162 per patient (41%) in predicted annual medication cost compared with the pre-intervention group. The numbers are too small for statistical analysis. These findings are interesting, however, and should stimulate further work.

Table 4 shows that the predicted annual saving per patient is much higher for intervention patients than for pre-intervention patients. These data are calculated by subtracting the cost of drugs on admission from the cost of

Table 2 Total cost of drugs on admission and discharge

	Annual cost of preadmission drugs	Predicted annual cost of discharge drugs	Difference between admission/discharge costs	Mean increase in annual medication cost post discharge per patient	% increase in drug costs between admission and discharge
Pre-intervention	£22625	£32238	+£9613	£181	42.3%
Intervention	£30753	£36855	+£6102	£122	19.8%

Table 3 Drug costs per disease area

	Mean annual cost per patient (£)		
	Admission drug cost	Discharge drug cost	Change in cost between admission and discharge
Congestive cardiac failure			
Pre-intervention (6 patients)	218	436	+218
Intervention (5 patients)	731	799	+68
Chronic obstructive pulmonary disease (COPD)			
Pre-intervention (4 patients)	950	1306	+356
Intervention (3 patients)	554	392	-162
Stroke			
Pre-intervention (4 patients)	178	1153	+975
Intervention (3 patients)	708	1381	+673

drugs being taken before discharge. The number of drugs stopped relates to drugs being discontinued on the PTWR.

Of the 53 patients in the intervention group, 109 recommendations for medication changes were made in 44 patients. Table 5 shows the number of recommendations regarding medication use including safety issues as documented by the PTWR pharmacist in the intervention group. No recommendations were documented by the ward pharmacists in either the pre-intervention or intervention groups. Most of the recommendations were either minor or moderate. The four major recommendations relate to potential problems that could result in major permanent harm to the patient which have significant risk for the trust and the patient.

Table 5 shows that most recommendations were related to the prescribing of medication, with direct supply, monitoring, and patient counselling being less evident. This is not surprising as supply and counselling usually take place outside the ward round setting.

LESSONS AND MESSAGES

Drug history

These data confirmed our suspicion that medication management was suboptimal in our hospital. Almost all medication histories were modified when a pharmacist was present on the PTWR, whereas only half were modified in the pre-intervention group. This may be because of a true difference between the two groups. The literature suggests that drug histories taken by doctors are often inaccurate,⁹ which supports our findings where 24 of 50 patients in the pre-intervention group had discrepancies between their documented drug history and the drugs they were actually taking.

Previous studies have shown that drug history taking by a pharmacist improves the accuracy of patient drug histories.¹⁰ When a patient is admitted to hospital, the admitting doctor will record a drug history. However, this will often be out of hours when access to confirmation from others is more difficult and there is pressure to complete other tasks as a priority. In contrast, the pharmacist in this study accessed information on drug histories during the day and focused on confirming information about medication with the patient, carer, relative, GP, and community pharmacist (as

appropriate). In addition, patients are usually unwell at admission which decreases the reliability of the history and, if the admission is unplanned, the patient is unlikely to have brought their medication with them to the hospital. The admitting doctor is unlikely to have time to investigate the medication history further. One contributing factor to the inaccuracy in taking drug histories by doctors is the lack of teaching about therapeutics and prescribing at the undergraduate level.¹¹

Dodds¹⁰ has described the benefits of pharmacists taking drug histories. The PTWR pharmacist is best placed to do this as the patient and medical team are present and will discuss medication related issues on the ward round. The pharmacist can contact the GP, carer, or community pharmacist to obtain further information in support of prescribing decisions. Any errors or omissions may then be addressed on the ward round when all relevant health professionals are attending the patient. The study shows that the drug history is more accurately taken when a PTWR pharmacist is available, thus improving patient safety and optimising treatment early in the patient's admission.

Drug expenditure

We hoped that improved medicines management would reduce expenditure and this was shown to be the case in our hospital. We expected drug costs to increase from admission to discharge, given that medication is the most common treatment for medical patients in hospital.⁵ However, this study shows that the increase in medication cost can be reduced by the PTWR pharmacist through advice to the medical team regarding optimisation of medicines.

The group sizes precluded matching with respect to age, sex, or general diagnoses. However, when the three most common admitting diagnoses to both groups were analysed, there was a greater increase in discharge medication cost per patient in the pre-intervention group (table 4).

The results show that more drugs were stopped in the intervention group than in the pre-intervention group. There was also a large potential cost saving shown for the intervention group (£88.60 per patient per year) compared with the pre-intervention group (£5.52 per patient per year). The background rate of drugs stopped in the pre-intervention

Table 4 Cost of drugs stopped from admission to discharge

	No of patients	No of patients in whom drugs were stopped	No of drugs stopped	Predicted cost saving from drugs stopped per annum	Mean saving per patient per annum
Pre-intervention	50	3	5	£276	£5.52
Intervention	53	19	42	£4699	£88.60

Table 5 Type and number of recommendations made by PTWR pharmacist

Type of recommendation	No of recommendations
Patient counselling	2
Education (healthcare staff, carer, patient)	4
Monitoring drug therapy	6
Provide drug (supply)	7
Select drug dose (modify dose)	29
Select drug (recommendation)	30
Review drug need	31

group reflects the alterations made according to clinical need, but usually without overall medication review. The PTWR pharmacist may have initiated medication review and contributed to the evidence base for stopping, changing, or starting drugs as this is the focus of the PTWR. This contrasts with clinicians who have a broader range of responsibilities. Advising clinicians on the choice of drugs and appropriate dose regimens reinforces the medical knowledge of clinicians with the specialist drug knowledge of senior pharmacists. This provides continuing education for both professions as well as improving patient care.

This study has shown that there are additional benefits for patients to the presence of a pharmacist on the PTWR compared with the existing ward pharmacy service in our hospital. PTWR pharmacists can most effectively contribute at the prescribing stage on the PTWR, ensuring that most effective medication optimisation occurs as part of the clinical team.¹²

Risk

During the study period of just three PTWRs involving only 53 patients, 109 recommendations were made, giving an intervention rate of approximately two per patient. Of these, four were classified as preventing a potentially major incident. Most were classified as moderate interventions.

A study by Psaila *et al*¹³ showed that, of 87 interventions made by junior pharmacists over 3 months, there were 0.18 interventions per patient. Most interventions were of minor significance. This paper suggests that a senior pharmacist will initiate more interventions of greater consequence to patients than a junior pharmacist.

No recommendations or risk reductions were documented in the pre-intervention group. In the post-intervention group, ongoing patient care was improved as the PTWR pharmacist documented recommendations and passed on the information to the ward pharmacist allowing follow up.

The main areas of recommendations made by PTWR pharmacists to minimise patient risk and maximise efficacy were in drug choice, dose, and review of drug need. These data concur with other work.⁷ Such information should be passed on to the GP in the discharge letter to inform primary care of changes made, together with the rationale.

Table 6 Recommendations from pharmacists by significance

Significance (see Appendix 1)	No (%) of recommendations
Minor	58 (53%)
Moderate	48 (43%)
Major	4 (5%)

Key messages

- Pharmacists can increase the accuracy of admission drug histories.
- Post-take ward round (PTWR) pharmacists can effectively contribute at the prescribing stage on the PTWR.
- Recommendations by pharmacists for optimising drug therapy can decrease the cost of prescribing by £500 000 across the health economy.

CONCLUSION

PTWR pharmacists improve the accuracy of drug history taking, patient safety, and optimise treatment. They can reduce drug cost at discharge and reduce patient risk.

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A risk assessment tool for assessing the level of incident investigation required and the external reporting requirements to the NPSA following adverse incidents involving NHS patients is shown in Appendix 1 available online at <http://www.qshc.com/supplemental>.

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Funding for a post-take ward round pharmacist has been granted as a result of this study. The cost of a full time post-take ward round pharmacist is approximately £48 000 inclusive. Predicted savings to the trust for 25 patients admitted per day, weekday service only, may be as high as £500 000 per annum as predicted from our data (estimation based on 25 admissions per day, 5 days per week, 46 weeks per year).

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